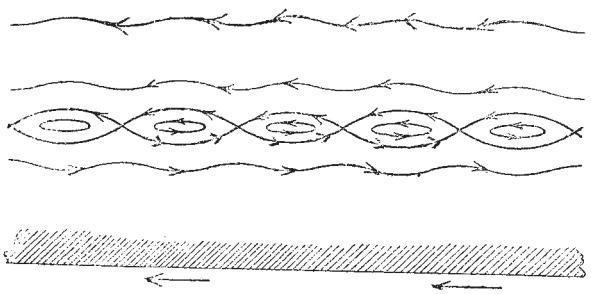
but the interpretation of the infinity which occurs in the more comprehensive formula suggests an examination of the stream-lines by which its interpretation becomes obvious, and which proves that even in the case of constant vorticity the motion has a startlingly peculiar character at the place where the translational velocity is equal to the wave velocity. This peculiarity is represented by the annexed diagram, which is most easily understood



if we imagine the translational velocities at $y = 0$ and $y = a$ to be in opposite directions, and of such magnitude that the wave velocity is zero; so that we have the case of standing waves. For this case the stream-lines are as represented in the annexed diagram, in which the region of translational velocity greater than wave-propagational velocity is separated from the region of translational velocity less than wave propagational velocity by a cat's-eye border pattern of elliptic whirls.

MINERAL RESOURCES OF NEWFOUNDLAND

ORES of copper have been found in all the older formations in Newfoundland, from the Laurentian gneiss at the base, to the Carboniferous series at the summit, the qualities of which vary greatly with the age and condition of the rocks with which they are associated. Thus in the Laurentian series the rich ores of variegated and sometimes grey sulphide of copper are more frequent than any other, and are for the most part in white quartz veins intersecting the strata; but while these ores have in many cases been found on analysis to yield at the rate of from 50 to 70 per cent. of metal, the quantities available at any one place hitherto tested have never yet been found sufficient to warrant an outlay of capital.

In the succeeding series, which I conceive to be the equivalent of the *Huronian* of *Canada*, and have provisionally called *intermediate*, as being intermediately situated between rocks of the Laurentian and Primordial Silurian ages, very rich ores of copper are likewise well known at many parts, chiefly in white quartz veins, and also in faults and dislocations, particularly near the junction with the fossiliferous Primordial, in which cases the indications may sometimes be regarded as favourable for the probable future development of mines. Several attempts have already been made in this direction at various parts of the distribution of the series, but except at a few places, chiefly near the junction with the newer formations, with but slender prospect of a successful issue.

By reference to the Custom House returns of exports I find that the amount and value of copper ore shipped at St. John's between the years 1854 and 1864 inclusive was as follows:—Ore, 627½ tons, value $22,980=4,596*l.* sterling. The places where this ore was raised are not specified, but I believe it was all derived from rocks of intermediate age, by which the greater part of the Peninsula of Avalon is occupied.

In addition to the above export from St. John's, 544 tons, valued at $19,179 were exported between the years 1875 and 1879; but a considerable, if not the larger portion of this ore was produced from Tilt Cove and other of the early openings in Notre Dame Bay.

Although the presence of copper is frequently indicated by stains of green carbonate and small nests of yellow sulphuret in the lower Primordial strata, I am not aware of any in tances where the ores occur in mass, or in intersecting veins or lodes, except it may be close to their immediate junction with the older series on which they repose unconformably or butt up against in faults. At some parts of their distribution, such as in the islands of Conception Bay, these older Silurian rocks are but very little disturbed, resting in nearly a horizontal attitude, and scarcely at all altered; at other parts, such as Trinity Bay, St. Mary's Bay, Langlois Island of the Miquelons and elsewhere, they are greatly disturbed by intrusions of igneous rock, and occasionally to some extent metamorphosed; but they are almost everywhere crowded with organic remains, the types of which indicate the ages they represent, to extend from the horizon of Primordial or Cambrian to the newer Potsdam Group of the United States and Canada. Strata representative of Potsdam, Calciferous, and Levis ages, containing abundance of typical fossils, are extensively displayed on the western and northern parts of the island, the former in many cases resting directly on Laurentian gneiss unconformably; but, except it may be to a very limited extent in Canada Bay, near the Cloud Mountains, I am not aware of any deposits older than the Potsdam at these parts, nor have I seen indications of the presence of the Huronian or intermediate system north of Bonavista Bay, or anywhere near the western shores. Galena in calcareous veins is of frequent occurrence in these Lower Silurian rocks, but except in small isolated crystals or patches the ores of copper are particularly rare, and in no case such as to be considered economically valuable.

But the cupriferous formations proper of Newfoundland, according to my view of the structure, lie unconformably above all the former, and consist mainly of a set of metamorphic and igneous rocks, corresponding exactly in mineral character and condition with the rocks of the Eastern Townships of Canada described by Sir Wm. Logan under the title of the Quebec Group. I am quite aware that these views, as regards the structure, are at variance with those entertained by several distinguished geologists in Canada (whose opinions, however, do not seem to be very unanimous on the subject); and there cannot be a doubt that in many cases the evidences appear to be so contradictory at different localities that the difficulties in arriving at the truth are exceedingly great. Nevertheless, so far as my own observations go, and I have studied the succession at nearly all parts of their distribution in Newfoundland, I am led to the conclusion that the stratigraphical position of this metamorphic group belongs to a horizon intermediate between the Calciferous and Hudson River group, probably chiefly of Chazy age, which is in accord with the structure of Sir W. E. Logan.

The group consists of chloritic, dioritic, and felsite slates, interstratified with compact diorites, bands of red jasper, dolomites, great masses of serpentine, or serpentinous rock, and volcanic products. In nearly all these rocks the ores of copper are more or less disseminated; but it is amongst the schistose portions, especially the clorite slates, that they seem to be most abundant, and it is in rocks of that quality chiefly where the principal mining operations have hitherto been conducted. At some parts of the distribution these rocks are distinctly stratified, the lines of deposit being well displayed in layers of different quality: beds of jasper, conglomerate, &c. The whole series is magnesian, more or less, but particularly towards the top, which appears to be the horizon of the serpentinous masses, with large accumulations of volcanic ash. Towards the base the rocks become calcareous, the cliffs of strata much incrusted with carbonate of lime; and some strata of a pure white crystalline limestone occur which are fossiliferous. The fossils are too obscure to be identified with certainty; but one form bears a strong resemblance to a *Maclurea*, another to a *Bellerophon*, a third to a *Murchi onia*, and some rather large-sized *Encrinite* stems. Near the horizon of this limestone moreover we find a set of black slates which contain graptolites. Vast intrusive masses of granitoid rock, and great dykes of greenstone melaphyre and other traps intersect the formation.

The only mines of importance in active operation up to the present time are all situated in Notre Dame Bay, and these are Union Mine Tilt Cove, Betts Cove Mine, Colchester, in south-west arm of Green Bay, Little Bay Mine, Rabbit's Arm, and Seal Bay. Many openings and minor workings have also been made at various parts of the bay, at each of which the ores of copper were more or less indicated, some of which may eventually, when capital and skilled labour are brought to bear, be found sufficiently remunerative to be worked to advantage.

It will be seen by the annexed memoranda that the total value of the copper and nickel ore extracted since 1854, but by far the larger proportion since 1864, when the Union Mine Tilt Cove was first opened by Mr. Smith McKay, amounts to nearly one million sterling.

Memoranda showing the Quantities and Values of Copper and Nickel Ores exported from the Island of Newfoundland in the undermentioned Years

Years.	Parts cleared from.	Copper.	Nickel.	Value.	Value of nickel ore.
		Tons.	Tons.	Dollars.	Dollars.
1854 to 1864	St. John's	627½[1]		22,980	
1875 to 1879	,,	544½[1]		19,179	
	Total St. John's ...	1,172		42,159	
1869	Union Mine Tilt Cove	5,938	30	190,016	7,200
1870	,,	4,218	88	134,976	8,800
1871	,,	1,924	7	61,568	700
1872	,,	4,774[3]	8	152,768	25,60
1873	,,	5,414	233	189,490	9,320
1874	,,	4,346	—	104,304	—
1875	,,	4,838	17	179,006	1,360
1876	,,	6,464	28	232,704	2,800
1877	,,	5,389	—	194,004	—
1878	,,	4,450	—	97,966	—
1879	,,	1,964	—	35,352	—
	Total Tilt Cove ...	49,719	411	1,572,154	32,740
1875	Bett's Cove	6,280		232,360	
1876	,,	18,670		456,481	
1877	,,	42,065		1,093,768	
1878	,,	31,370		690,140	
1878	Regulus	750		34,500	
1879	,,	26,421½		475,587	
	Total Bett's Cove ...	125,556½		2,982,836	

The ores returned for 1878–79 were largely derived from Little Bay Mine and partly from Colchester, all belonging to the Bett's Cove Mining Company.

Thus the total value of the ores of copper and nickel exported since 1854 amounts to $4,629,889, or nearly £1,000,000 sterling.

ALEX. MURRAY

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—In Groups C and E of the Higher Local Examination this year there were respectively fifty-four and ninety-nine candidates; five obtained a first class in Group C (Mathematics) and eight a first class in Group E (Natural Science); nine candidates failed in Group C, and twenty-six failed in Group E. Three candidates answered the questions in Differential and Integral Calculus, and showed considerable knowledge. In botany a fair average of proficiency was attained; in geology the papers were below the average. In zoology inferior text-books had been too much preferred, to the exclusion very largely of practical work. The work in chemistry was unequal, but some candidates showed a very good acquaintance with the details of manipulation. Physics can scarcely be said as yet to be studied by the candidates. In physiology the answers were in some cases accurate and to the point, but the majority of candidates failed.

The elections to the Council of the Senate were made on Monday, and show in a very practical manner that residents are in favour of considerable improvement in University matters. Only one member who approves of the retention of Greek as a universal subject in the "Little-go" was elected, viz., Mr. G. F. Browne, whose place in the Council is due to his active work in connection with the University Local Examinations and his knowledge of the intentions of the University Commissioners, as one of their secretaries.

[1] Chiefly from Huronian rocks.
[2] Partly from openings in Notre Dame Bay.
[3] Cloanthite and Millarite.

Dr. Phear, Professors Cayley and Liveing, and Mr. Peile, are among those who were elected to the Council well known for their scientific eminence and breadth of view.

Prof. Stokes, Lord Rayleigh, and Mr. Vines were added to the Council of the Philosophical Society at its annual meeting.

Mr. Forbes, Prosector to the Zoological Society, has been elected to a Fellowship at St. John's College.

AT an examination held on Wednesday, October 27th ult., Mr. M. Milburn, of Longtoun, was elected to a vacant bursary in connection with the "Young" Chair of Technical Chemistry, Anderson's College, Glasgow. The bursary, which is of the value of 50*l.*, and tenable for three years, is the gift of Mr. James Young, LL.D., F.R.S., of Kelly and Dullis, founder of the Chair.

SCIENTIFIC SERIALS

Journal de Physique, October.—Experimental verification by S. Carnot, of the principle he discovered, by M. Lippmann.—Apparatus and experiments for elementary demonstration in optics, by M. Gariel.—Influence of velocity of propagation of sound in the shock of elastic bodies, by M. Elie.—New form of plates for air pumps, by M. Terquem.—*Proceedings* of the Physical Society of St. Petersburg (including papers, in abstract, on the chemical and photographic action of light, the transmission of the current in water with unequal platina electrodes, variations of volume and coefficient of elasticity of palladium and its alloys under the influence of absorbed hydrogen, &c.).

Rivista Scientifico-Industriale, No. 18, September 30.—On the relation between terrestrial storms and the planetary relations of the solar system, by Prof. Zenger.—Excursions (geological) in the neighbourhood of Modica, by Prof. Lancetta.—Palæontological studies in Bohemia, by Prof. Fritsch.—Beats, the third sound of Tartini, and the differential resultant sounds of Helmholtz, by Dr. Crotti.

No. 19, October 15.—New registering pluviometer, by S. Grimaldi.—New apparatus with petroleum heating, by S. Esser.—On a new variety (Rosterite) of Elban beryl, by Prof. Grattarola.

Kosmos, July 1880, contains a translation of Prof. Huxley's "The Coming of Age of the Origin of Species" (*vide* NATURE, vol. xxii. p. 1).—Dr. Ernst Krause's sketch of the developmental history of the History of Development.—Dr. H. Müller, the importance of Alpine flowers in connection with the "flower theory."—H. Schneider, observations on some apes.—Prof. Dr. Caspary, the conception of a soul and its significance in connection with modern psychology.—Short contributions and extracts from journals (among the short articles is one on the resemblance between flowers and fruit, by Hermann Müller, and on the occurrence of a five-toed example of *Archibuteo lagopus*, by W. von Reichenau).

August, 1880.—Dr. Oscar Schmidt, the severance of species and natural selection.—Dr. Ernst Krause, sketch of the developmental history of the History of Development, No 2.—Dr. Herman Müller, on the development of the colours of flowers.—Prof. A. H. Sayce, on the history of writing (translation).—Short contributions and extracts from journals.—Literature and critical notices.

Revue des Sciences Naturelles, September.—M. Mathias Duval, on the development of the spermatozoa in the frog (plates 3 and 4).—M. Lavocat, on the construction of the extremities of the limbs.—Dr. A. Godron, on the absence of a glume in the lateral spikelets of Lolium.—M. Leymerie, sketch of the Pyrenees of the Aude.—Notices of French memoirs on zoology, botany, and geology.—Bibliography and notice of the death of Dr. A. Godron.

SOCIETIES AND ACADEMIES

LONDON

Chemical Society, November 4.—Prof. H. E. Roscoe in the chair.—The following papers were read:—On the compounds of vanadium and sulphur, by E. W. E. Kay. The author shows that the products obtained by Berzelius are oxy-compounds, that the substance obtained by Berzelius in the dry way is a true trisulphide of vanadium V_2S_3; the disulphide and pentasulphide have also been prepared and are described in the present paper.—On the atmospheric oxidation of phosphorus and some reactions of ozone and peroxide of hydrogen, by C. T. Kingzett. The author concludes that in the above oxidation both ozone and peroxide of hydrogen are formed, the former